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## A TEST FOR A FUNCTIONING MARKET ECONOMY: SETON'S EIGENPRICES OF TURKEY

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We use Seton's eigenprices to see if some evidence can be found in support of the European Commission's official statement that the Turkish economy can be considered as a functioning market economy. Given an input–output flows matrix, there is a unique set of prices for outputs and production factors compatible with final demand, generating demand for factors. The findings based on Turkey's most recent I–O table and comparable I–O matrices for Romania and Poland (two EU members) in 2005 show that price distortions were on average five times larger in Turkey. Hence, based on price distortions alone, there was no solid evidence in support of the statement that Turkey had a functioning market economy.

*Keywords:* Eigenprices; Eigenrentals; Input–output; Market economy

### 1. INTRODUCTION

One of the two economic accession criteria approved by the European Council in Copenhagen states that an acceding country must have a functioning market economy (EC, 1993). The European Union (EU) defines a functioning market economy as an economy in which the prices of goods and services are determined by the forces of the free market (Altwater, 1993), trade is liberalized, and a well-developed financial sector with no barriers exists (EC, 2005). About a decade ago, the European Commission stated in its Progress Report that “Turkey can be regarded as a functioning market economy as long as it firmly maintains its recent stabilization and reform achievements” (EC, 2005; SPO, 2007a). But, how can one test empirically whether an economy is a functioning market economy? Various statistical tests, like those on “the efficient market hypothesis”, focus too much on financial markets for being comprehensive enough to provide an across-the-board answer covering all sectors and factor markets. Computable general equilibrium models, such as the Australian MONASH model (Dixon and Rimmer, 2002), require enormous data sets including I–O matrices, estimates of a large number of behavioral parameters. We believe that Seton's eigenprices based on the Leontief inter-industry transaction matrices can provide a simple overall test, despite some of its objectionable assumptions. In this study, we have employed Seton's approach to test if the Turkish economy has been a functioning market economy. We were motivated by Tinbergen's comments (see foreword to Seton,

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1992) that each output is priced in accordance with its factor cost and each factor is valued in line with its contribution to the final commodities. We were also motivated by empirical research that followed Seton (1982), such as Dietzenbacher and Steenge (1985) and Dietzenbacher and Wagoner (1999). We have adopted Seton's model and his methodology in general, but we deviated from Seton's work in that we employed a more disaggregated I–O model and weighed the structural eigenprice vectors as is explained later.

In this study, we used the two most recent I–O tables for Turkey (1998 and 2002) to calculate eigenprices for outputs and eigenrentals for factor inputs. These prices were then subjected to an overall test, by comparing them with sets of eigenprices computed from two I–O matrices of Romania and Poland (two of the most recent member states of the EU). The reason for the comparative evaluation of the price structures of these three countries becomes clear when we consider the EU membership status of these three countries. We assume that both Romania and Poland had to fulfill the functioning market economy requirements before becoming members of the EU. Despite their common market orientation, Turkey's economy has still been controlled by the state through tax restrictions, protection, and imperfect competitive market structures, whereas Romania and Poland have been exposed to a large extent to market competition, at least within the boundaries of the EU. Hence, testing the hypothesis that scarce resources are better allocated and priced in these member countries than in Turkey can shed some light on the relative positions of the three countries with respect to functioning market conditions. In this study, we calculate how much the eigenprices of the three countries deviate from unity; that is, we look at Seton's normative standard under perfect competition, and how these deviations compare to one another.

A market economy has been the primary objective of Turkey, particularly after the economic liberalization program of 1984. To secure fair prices for products and primary factors, several steps have been taken, including the establishment of the Authority for Competition and the program of privatization of the so-called State Economic Enterprises all in line with the market rules of the EU (SPO, 2007a) and in accordance with the International Monetary Fund (IMF) stand-by agreements (SPO, 2007b; Treasury of Turkey, 2008). Structural reforms were put into effect that aimed at enhancing market mechanism by strengthening producers' organizations in agriculture and rural areas, downsizing the share of state through privatization, liberalizing foreign trade with floating exchange rates, and restructuring the banking industry. The ultimate aim of these radical steps was to remove market imperfections (Treasury of Turkey, 2008). The Law on the Protection of Competition has been implemented without discrimination between public and private economic entities. The World Economic Forum ranked Turkey at 51 on a global level in 2005 with respect to international competitiveness (SPO, 2006).

Seton's approach has been empirically used for interspatial and inter-temporal comparisons as well as diagnostic purposes. Seton himself studied 15 European economies including the former USSR for price distortions (Seton, 1985). He found, for example, that in 7 of the 15 countries, products of agriculture were underpriced, and beverages and tobacco products were substantially overpriced. Dietzenbacher and Steenge (1985) used Seton's methodology to diagnose and compare price distortions in the Netherlands and Hungary and concluded that deviations of eigenprices from unity were smaller in the Netherlands than those in Hungary, and this could reflect the fact that prices in the Netherlands were determined more freely. Similar studies based on Seton's methodology were also conducted for comparing Austrian and Hungarian markets (Fink, 1981) and

West German and East German markets (Dietzenbacher and Wagener, 1999). Others view Seton's work as a new theory of value and as a useful approach for international and inter-temporal comparisons of economic structures and performances (Dixon 1986).

In the next section, we first present Seton's model. The data used for this study are briefly discussed in Section 3. Section 4 contains the findings and interpretations of these. Finally, we state our conclusions.

## 2. MODEL

Seton's model for eigenprices and eigenrentals is compactly described in matrix and vector notation. The basic system of equations with input–output matrices is (in what follows, the number of industries is indicated by  $n$ , and the number of production factors by  $k$ ):

$$\mathbf{x} = \mathbf{Ax} + \mathbf{f}, \quad (1)$$

$$\mathbf{w} = \mathbf{Bx}. \quad (2)$$

The typical element of the  $n \times 1$  vector  $\mathbf{x}$  ( $x_j$ ) gives the output of sector  $j$ . The typical element of the  $n \times n$  input coefficients matrix  $\mathbf{A}$  ( $a_{ij}$ ) indicates the value of intermediate input  $i$  used to produce the unit value of output in  $j$ . Each element  $f_i$  of the  $n \times 1$  vector  $\mathbf{f}$  stands for deliveries by sector  $i$  to final demand. In Equation 2, each element of the  $k \times 1$  vector  $\mathbf{w}$  shows the total amount of the corresponding primary factor used in the economy as a whole, since the typical element  $b_{mj}$  of the  $k \times n$  matrix  $\mathbf{B}$  represents the value of factor  $m$  used directly in the production of unit value output of sector  $j$ . From Equations 1 and 2, we obtain the first system of equations in Seton's model:

$$\mathbf{C} = \mathbf{B}(\mathbf{I} - \mathbf{A})^{-1}. \quad (3)$$

An element  $c_{mj}$  of the  $k \times n$  matrix  $\mathbf{C}$  shows the value of factor  $m$  required (directly and indirectly) by a unit value of product delivered for final demand purposes by sector  $j$ . The cost-values of products  $\mathbf{p}'$  (an  $1 \times n$  vector) given the  $(1 \times k)$  vector of primary factor rentals  $\mathbf{r}'$  and a uniform markup  $1/\tau$  to account for profits or taxes are now calculated as

$$\mathbf{p}' = \left( \frac{1}{\tau} \right) \mathbf{r}' \mathbf{C}. \quad (4)$$

Equation 4 reflects “valuation by cost”.  $\mathbf{r}'$  contains rentals per unit of production factor.

The second set of equations of the model is the so-called  $\mathbf{N}$  matrix or the “norm matrix”. To calculate total primary factors required by total deliveries to final demand, the  $\mathbf{C}'$  matrix is pre-multiplied by the diagonalized final demand vector, that is,  $\hat{\mathbf{f}} \mathbf{C}'$ , resulting in an  $(n \times k)$  matrix, the typical element of which  $d_{jm}$  stands for the value of the primary factor  $m$  needed directly and indirectly by the total final demand for the output of sector  $j$ . Seton calls this matrix  $\hat{\mathbf{f}} \mathbf{C}'$  “the yield products of the sector”. By dividing these total factors required directly and indirectly by  $\mathbf{f}$  by the total factors  $\mathbf{w}$  required directly by the sectors, we obtain the norm matrix:

$$\mathbf{N} = \hat{\mathbf{f}} \mathbf{C}' \hat{\mathbf{w}}^{-1}. \quad (5)$$

The typical element of the  $n \times k$  matrix  $\mathbf{N}$  ( $n_{jm}$ ) gives the quantity of factor  $m$  required directly and indirectly by total final demand, per unit of the same factor required directly

in the same sector. The norm matrix is the central system of equations by which, given product prices which are assumed to reflect utilities of final users in the final demand markets, values are assigned to each of the primary factors in line with their contributions to products delivered to final demand.

$$\mathbf{r}' = \mathbf{p}' \mathbf{N}. \quad (6)$$

In Seton's words this is "valuation by use". Having an estimate of a row vector of product prices  $\mathbf{p}'$ , one can obtain factor prices. Given the cost  $\mathbf{C}$  and norm  $\mathbf{N}$  matrices, Equations 4 and 6 may be solved for the unknown prices and rentals in an iterative approach once we start with an arbitrary vector of factor prices. However, a more convenient approach for solution is to insert  $\mathbf{p}'$  of (4) into (6) and  $\mathbf{r}'$  of (6) into (4) to get the "cost-norm" and the "norm-cost" equations (Seton, 1985; 1992; Dietzenbacher, 1992; Dietzenbacher and Wagener, 1999) as follows:

$$\left[ \frac{1}{(1 + \tau)} \right] \mathbf{p}' = \mathbf{p}' \mathbf{N} \mathbf{C} \quad \text{and} \quad (7)$$

$$\left[ \frac{1}{(1 + \tau)} \right] \mathbf{r}' = \mathbf{r}' \mathbf{C} \mathbf{N}. \quad (8)$$

The left-hand eigenvector of  $\mathbf{N} \mathbf{C}$  associated with the dominant eigenvalue (Equation 7) results in the vector of eigenprice structure for products, yet to be standardized. Eigenrentals are then calculated from Equation 6.<sup>1</sup> Since eigenvectors are defined up to a multiplicative constant, they can be standardized, so that the mean price is unity. Seton (1985) proposed to standardize by using the ratio of the observed sum of final demand Gross National Product (GNP) and the new GNP recalculated at eigenprices.<sup>2</sup>

As Seton put it, "eigenprices are prices at their marginal costs in terms of factors absorbed in their production" and "factors are priced at the marginal contribution they make to the total value of commodities so priced" (Seton, 1985, p. 15). This can be interpreted as factor prices are equal to the marginal revenues of products, which is the dual solution of the good's market in the perfectly competitive factor markets. Hence, eigenprices and eigenrentals are prices that are determined as if markets were fully competitive. They are considered as economically rational (Seton, 1992; Dietzenbacher and Steenge, 1985) insofar as they reflect not only contributions of production factors such as labor and capital to final goods and services, but also utilities derived by the final consumers as revealed by the observed set of final demands.

If markets function well, the solution of the model gives eigenprices that are equal to unity. Hence, market distortions are indicated by the size of deviations of eigenprices from one. Higher deviations are interpreted as larger distortions brought about by market imperfections (Dietzenbacher and Steenge, 1985). An eigenprice equal to, say, 1.25 would indicate that the respective output is undervalued (underpriced) by 20%  $((1 - 1/1.25) = 0.2)$ , and a primary factor with an eigenrental equal to, say, 0.9 would indicate

<sup>1</sup> Alternatively, one may get the left-hand eigenvector of  $\mathbf{C} \mathbf{N}$  for the structure of eigenrentals and then calculate eigenprices from Equation 4.

<sup>2</sup> In our empirical analysis, we employed Gross Domestic Product instead of GNP. The difference between the two concepts is the net property income from abroad. We do not expect this difference to distort the calculations given its small magnitude.

that the respective factor is overvalued by about 11%. As a final point, we shall briefly present the nature and significance of the so-called eigensurplus as revealed by the eigenprices and rentals. Suppose we pre-multiply the I–O flow matrix by the eigenprices and rentals and obtain a new I–O flow table. The row sums of the new flow table provide the new output levels implied by the eigenprices ( $p_i x_i$ ). Subtracting now all the flows for intermediate and factor use column wise from the new output results in the total level of eigensurpluses by sectors, as residuals. These surpluses, in values, are expected to be different for each sector. But the ratio of this surplus to value-added is uniform for all sectors. The ratio  $\tau$ , which can also be derived from the dominant eigenvalue  $[1/(1 + \tau)]$ , is uniform across the sectors in Seton's model, and the larger (smaller) the magnitude of the eigensurplus, the smaller (larger) the proportions of product prices paid to factors. To put it differently, a smaller surplus ratio implies a lower value-added tax that can be extracted from the economy. For a functioning market economy, the eigensurplus ratio  $\tau$  is expected to be smaller relative to a distorted economy, implying that a larger proportion of income created is transferred to factors. For example, a comparison of eigensurplus ratios between East Germany (GDR) and West Germany (FRG) concluded that the eigensurplus ratio was much smaller in West Germany, and this was taken as a confirmation of the hypothesis formulated above (Dietzenbacher and Wagener, 1999).

### 3. DATA

The data used for this paper consist of the two most recent I–O tables (for 1998 and 2002) for Turkey's economy (TUIK, 2008) and, for comparison, the I–O tables for Romania and Poland for 2005.<sup>3</sup> Since all tables were made comparable, for example, using the same format, definitions, and aggregations, there was no need for any further adjustment. The original sets of I–O tables are in a 97-sector breakdown and were aggregated to 30-sector tables, the key of which is given in the Appendix (Table A.1). Following Dietzenbacher and Wagener (1999), we employed input coefficients that reflect domestically produced inputs as well as imported goods for intermediate use. The final demand is the sum of private and government consumption, gross capital accumulation, changes in stocks, and exports. The value-added portions of the tables cover the following: (i) compensation of employees (wages and salaries plus fringe benefits), (ii) consumption of fixed capital assets (basically depreciation), and (iii) other factor payments covering profit, rents, and other factor incomes not included elsewhere. Value-added taxes minus subsidies are left out as residuals in our calculations.

### 4. FINDINGS AND DISCUSSION

Table 1 shows the eigenprices for the outputs of 30 sectors and eigenrental rates for the primary factors in Turkey for 1998 and 2002. An overall examination of the findings shows that the average deviation of eigenprices from unity (weighted by the respective shares of

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<sup>3</sup> We have employed the I–O of 2005 for both countries, since Poland had become member of the EU just a year before (in 2004) and Romania became a member only two years later (in 2007).

TABLE 1. Eigenprices of outputs and eigenrentals of factors, Turkish Economy.

No.	Sector Name	Eigenprice 1998	1998 Sector's share in FD at eigenprices (%)	Eigenprice 2002	2002 Sector's share in FD at eigenprices (%)
1	Agriculture, hunting and forestry	1.2774	11.5	1.1892	13.1
2	Fishing	1.2363	0.4	1.1917	0.5
3	Mining and quarrying of energy-producing materials	0.3524	0.0	0.2274	0.0
4	Mining and quarrying except energy- producing materials	0.9809	0.1	0.9325	0.1
5	Manufacture of food products; beverages and tobacco	1.0046	7.9	1.0432	7.9
6	Manufacture of textiles and textile products	0.9387	4.5	1.0411	4.5
7	Manufacture of leather and leather products	0.7997	0.4	0.9385	0.4
8	Manufacture of wood and wood products	1.0859	0.2	0.9240	0.2
9	Manufacture of pulp, paper, paper products; publishing and printing	1.0294	0.5	0.9383	0.5
10	Manufacture of coke, refined petroleum products	0.8864	0.6	0.4219	0.2
11	Manufacture of chemicals and man-made fibers	0.4684	1.2	0.5334	0.6
12	Manufacture of rubber and plastic products	0.7358	0.8	0.7863	0.6
13	Manufacture of other nonmetallic mineral products	1.0125	0.4	1.0297	0.4
14	Manufacture of basic metals and metal products	0.6266	1.1	0.6252	0.7
15	Manufacture of machinery and equipment n.e.c.	0.4528	2.0	0.5206	1.0
16	Manufacture of electrical and optical equipment	0.4109	1.5	0.4585	0.6
17	Manufacture of transport equipment	0.5402	1.9	0.6201	1.2
18	Manufacturing n.e.c.	0.8901	2.1	0.7868	1.6
19	Electricity, gas, and water supply	1.0526	0.8	0.9884	0.8
20	Construction	1.0878	12.1	1.0397	12.1
21	Wholesale and retail trade; repair of motor vehicles,	1.2769	12.7	1.0934	13.3
22	Hotels and restaurants	1.0678	4.0	1.1931	4.6

(Continued).

TABLE 1. Continued.

No.	Sector Name	Eigenprice 1998	1998 Sector's share in FD at eigenprices (%)	Eigenprice 2002	2002 Sector's share in FD at eigenprices (%)
23	Transport, storage, and communication	1.0000	12.3	1.0865	12.7
24	Financial intermediation	1.1254	4.0	1.1432	4.4
25	Real estate, renting, and business activities	0.9694	4.0	1.0305	4.0
26	Public administration and defense; compulsory social security	1.3533	8.9	1.1546	9.8
27	Education	0.6896	0.5	1.1928	0.5
28	Health and social work	1.1382	1.7	1.2474	2.0
29	Other community, social, and personal service activities	1.0045	1.5	1.1117	1.6
30	Private households with employed persons	1.3925	0.0	1.1892	0.0
	Labor (wages and salaries)	1.0495		1.0087	
	Capital (capital consumption)	0.9529		0.9828	
	Other factor incomes (profit, rents, etc.)	0.9867		0.9980	

Source: Authors' calculations.

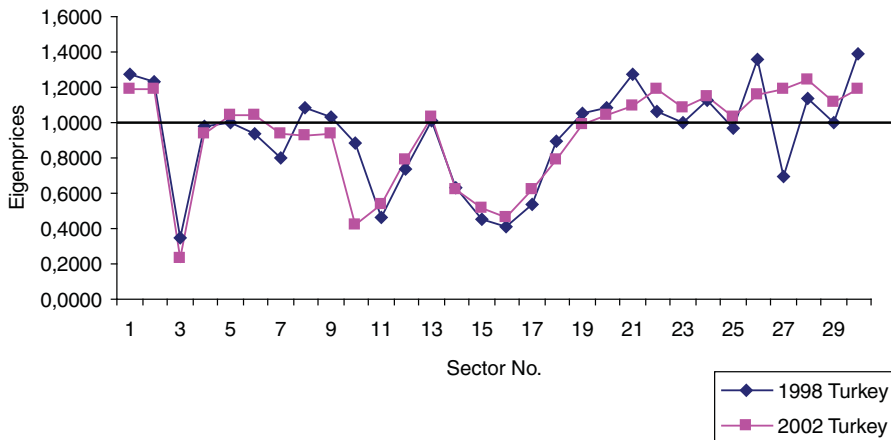
products in final demand) is 23.3% for 1998 and 17.3% for 2002.<sup>4</sup> Hence, price distortions in 1998 were on average greater than those in 2002, though the reduction is not sizeable enough to conclude that there was considerable progress in price correction mechanism over the five years.

The higher degree of price distortions in 1998 is no surprise given the fact that the country was going through chronic inflationary trends at high double-digit rates, under which prices were no longer accurate signals for resource allocations and low production levels accompanied high rates of unemployment. Financial problems associated with credit and foreign exchange risks within the banking system were out of control. However, immediately before and after the worst crises of the country in 2001, the disciplinary austerity programs designed and implemented in line with the IMF stand-by agreements and the Copenhagen criteria of the EU reversed the negative trends and diverted the country toward a relatively better market economy by 2002. For the factor markets, the distortions of eigenrentals from unity between 1998 and 2002 were small. We also find that the 2002 factor prices were much closer to unity, suggesting reasonable improvements in the functioning of labor and capital markets in Turkey. Improvements witnessed in the factor markets might be the results of radical steps taken since the end of the 1990s. The Turkish capital markets have been functioning reasonably free of restrictions since the 1984 financial liberalization program, which led to integration with international markets for

<sup>4</sup>  $SSE_{\text{weighted}} = \sum_{i=1}^{30} \left[ (p_i - 1)^2 \left( p_i f_i / \sum_{i=1}^{30} p_i f_i \right) \right]$ .



FIGURE 1. Sectors' eigenprices of Turkey for 1998 and 2002.



products and capital. A strong indicator toward that end is the foreign capital participation rate (over 65%) observed in the Istanbul stock exchange and the increasing numbers of mergers and joint ventures in the private sector, particularly in the banking industry. Significant progress has been witnessed in creating investors' confidence through the Investors Protection Fund and the registry system in stocks and bonds (SPO, 2006). The labor market has also been restructured itself with legal and institutional steps toward EU standards and the International Labour Organization requirements (SPO, 2006). Both for private and government sectors, wages and salaries are determined periodically through bargaining procedures between the labor unions and employers.

Admittedly, in order to implement a test of a functioning market economy, it is almost impossible to determine a statistical critical level, or thresholds below or beyond which a market economy is nonfunctioning.<sup>5</sup> We adopt an alternative approach, in which we compare results for the Turkish economy with those for some countries which had already become members of the EU. Figures 1 and 2 compare the 2002 eigenprices of the Turkish economy with those of Romania and Poland in 2005, while Table 2 focuses on differences in eigenrentals.

Looking at the scattering of eigenprices around the unity lines for Turkey and the two EU member countries (Figures 1 and 2), one striking observation is that deviations (the square root of the weighted sum of squared errors) are more than five times as high in Turkey as in the two member countries. It seems as if these two member countries have turned their economies to functioning markets indeed. A second finding concerns the different pattern of scattering in Turkey compared to the two member countries. In general, eigenprices for primary sectors display the same "underpricing" pattern in the three countries, though in varying degrees. This is in line with findings from other studies that these sectors are generally subsidized and supported. However, while the manufacturing sectors are generally overpriced in Turkey, these are "just-priced" or slightly underpriced in the two member countries. This suggests that Turkish manufacturing products were either still

<sup>5</sup> We owe this term to an anonymous referee.

FIGURE 2. Sectors' eigenprices of Romania (2005) and Poland (2005).

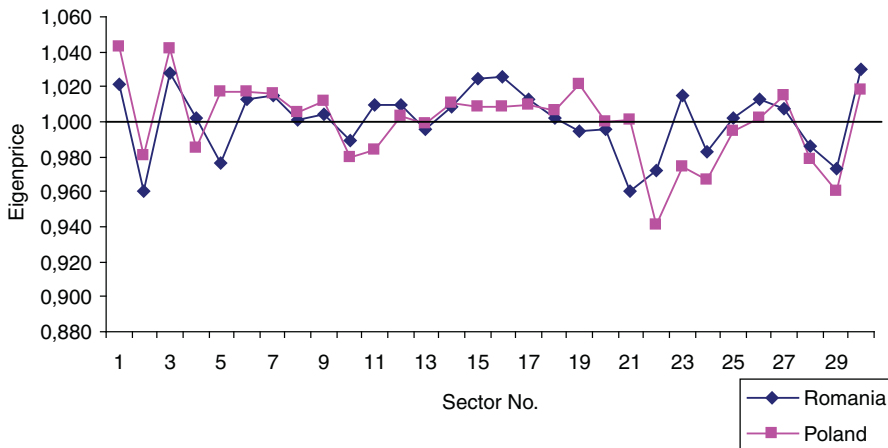


TABLE 2. Eigenrentals of Turkey, Romania, and Poland.

	Turkey (2002)	Romania (2005)	Poland (2005)
Compensation of employees	1.0087	1.0012	1.0147
Consumption of fixed capital	0.9828	0.9995	0.9739
Operating surplus, net	0.9980	0.9992	1.0114

protected (e.g. the car manufacturing sector), and/or display monopolistic or oligopolistic market structures, while such market imperfections were much less present in the two member countries. The service sectors show just the opposite pattern. While they are considerably underpriced in Turkey, they are either slightly overpriced or just-priced in the two member countries.

To see more clearly why the Turkish economy in 2002 could not be considered as a functioning market economy, we focus on some details pertaining to individual sectors. As was mentioned above, products from primary sectors, such as agriculture, forestry, and fishery, are consistently undervalued ( $p_i > 1$ ); manufactured products are generally overvalued ( $p_i < 1$ ); and service sectors are either justly valued ( $p_i = 1$ ) or undervalued. These findings are in agreement with other studies (Fink, 1982; Dietzenbacher and Steenge, 1985; Seton, 1985) that primary products tend to be undervalued largely because of subsidies and other support programs as well as the competitive structure of the producers, whereas luxury products are overvalued largely because they are subject to higher taxes, monopolized, or oligopolized.<sup>6</sup> Of particular importance to manufacturing sectors in this study are those that are found to be significantly overvalued. For 2002 these sectors are petroleum products (overvalued by 138%), transport equipment (basically car manufacturing, overvalued

<sup>6</sup> These studies focus on comparative evaluations across economic systems, for example, centrally planned economies versus market economies as well as economies across time. However whatever the emphasis, conclusions are that basic products tend to be undervalued and luxury products overvalued following the same line of reasoning.

by 61%), machinery and equipment (other than cars and trucks), electrical motors, chemicals, and rubber and plastic products overvalued at lesser amounts (Table 1). Petroleum products have been heavily taxed (excise taxes), which constitutes a source of substantial revenue for the governmental budget. The car manufacturing sector has been protected for decades now with high tariffs and other protectionist policies. On the other hand, the services sectors (sectors 21–30) are either justly valued or slightly undervalued, except for sectors 28 (health and social work), 27 (education), and 22 (hotels and restaurants). While the market for service sectors seems to be functioning better than that of manufacturing sectors, in general, the latter three service sectors are markedly undervalued. The reasons seem to be clear. Health services account for a majority of cost of the social security system and this together with the education sector has historically been heavily subsidized by the governments. While there are no subsidies for hotels and restaurants, this sector's undervaluation is largely due to the severe competition to which these sectors are exposed given the fast-growing tourism industry of the country and no market imperfections within the sector.

Finally, we present and discuss briefly the so-called eigensurplus ratio  $\tau$ . As explained in the model section above, this ratio can be derived from the I–O flow matrix revalued at eigenprices and eigenrentals. The eigensurplus for sector  $j$  is a residual amount after we subtract intermediate inputs and factor cost from the sector's output, all from the new I–O flow matrix. This represents the source of tax potentially extractable by the government or that part of the output surplus that can be redistributed to factors in addition to their current rental prices if no value-added taxes are to be collected. The eigensurplus ratio, obtained by dividing the surplus by the value-added for each sector, is expected to get smaller as the market functions better, causing increasing shares of output values to accrue to factors. This ratio, uniform for all sectors, is 24.6% for 1998 and 24.2% for 2002. It appears to improve slightly but, despite some corrections in prices discussed above, not to the extent to conclude that the overall economy was functioning better in 2002.

To sum up, Seton's eigenprices are tried in this study for the first time, to see if some evidence can be found in support of the EC statement that the Turkish economy could be considered as a functioning market economy and if there were some improvements in the pricing system between 1998 and 2002. Due to the difficulty of setting a threshold beyond which a market is classified as nonfunctioning, we compare eigenprices of Turkey with those of two recent member countries (Romania and Poland) of the EU to see to what extent the Turkish eigenprices were distorted. The findings of this study do not provide strong evidence in support of the statement made by the EU Commission that the Turkish economy could be considered as a functioning market economy.<sup>7</sup> However, the findings also indicate that between 1998 and 2002 there were considerable corrections in the majority of prices, except for a few sectors such as energy and car manufacturing.

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<sup>7</sup> Dietzenbacher and Steenge (1985) and Seton (1992) warn that eigenprices optimize nothing. They simply explain what is happening in the economy. Given the technical coefficients, final demands, and value-added, the eigenprices model assumes that the economy has already optimized a welfare function. Hence, eigenprices measure efficiency levels given resource utilizations. They are instrumental in revealing market imperfections or distortions. Moreover, Dietzenbacher and Steenge (1985) points out the arbitrariness of the standardization process, that is, the approach used to calculate absolute eigenprices. However, it is important to note that whatever approach is employed to standardize price structures (left-hand dominant eigenvectors of NC or CN matrices), the relative proportions among absolute prices will remain the same.

## 5. CONCLUSIONS

The aim of this study was to apply Seton's eigenprices of Turkey to two inter-industry transaction matrices to see if the claim made by the EC in conjunction with the Copenhagen criteria, that the "Turkish economy can be considered as a functioning market economy", is supported empirically, in terms of the product and factor valuations. Given the high degree of discrepancies of Turkish eigenprices relative to those of Romania and Poland, we conclude that there was no strong evidence in support of the statement made by the EU Commission. However, there is some evidence that the economy was moving toward a functioning market structure.

We are aware of some of the strong assumptions that underlie Seton's model. The conclusions reported above are therefore conditional on the truthfulness of the usual assumptions made in relation to I–O tables, that is, value flows versus physical flows, the aggregation problem, constant versus stochastic coefficients, and static versus dynamic structures. While all these problems are well known to I–O researchers (see, e.g. Bulmer-Thomas, 1982; Miller and Blair, 1985; Dixon, 1986; UN, 1999; Lenzen, 2001), the most serious criticism of Seton's model is the constancy of all the parameters.<sup>8</sup> For an eigenprice to be interpreted as a kind of valuation criterion (shadow price), it must be based on some behavioral parameters which can be derived from statistical distributions of them representing the responses of all the players, consumers, producers, production factors, and the like. Yet the "valuation by use" and "valuation by cost" in Seton's words are based on static I–Os with a single observation at a point in time. Can one conclude that whatever the final demand and/or value-added observed at a point in time are in line with Marshallian optimality conditions? The answer is not likely to be "yes" as evidenced by the degree of deviations of eigenprices and eigenrentals from the unity.<sup>9</sup> Second, any price impact study based on I–O matrices assumes that flows that are already aggregated at observed prices are in physical units, and therefore unit prices are assigned at the outset before calculations. But it is clear that values may already have been distorted because of wrong prices, and therefore eigenprices calculated may turn out to be biased or less useful. One last comment we must make is about the years, 1998 and 2002 of the I–O tables used for our calculations. The time span is not long enough to see what impact the Turkish markets have had from the several reforming programs implemented before and after the financial crisis of 2001. Regrettably, up-to-date I–O tables for the Turkish economy are not available yet. We understand that there are preparations in the TUIK to update I–O tables and publish them annually. Hence, future empirical analysis with Seton's model will have to be repeated with more recent I–O tables, to have a better understanding as to how the Turkish markets have progressed. Despite these criticisms, we are optimistic that Seton's model is a simple and practical one, though partial, for testing markets and hence worth trying to use.

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<sup>8</sup> Seton (1992) himself lists and discusses some of the problems underlying his model.

<sup>9</sup> Seton (1985, pp. 40–41) assumes that: "the coefficients observed in a given year have already undergone a process of adaptation to underlying preferences, aspirations and constraints whether perceived by atomistic producers in the light of market signals or directly selected by planners, policy makers or dictators". He assumes them as given and focuses on the ex post evaluation of the static structure.

## SUPPLEMENTAL DATA

Supplemental material for this article is available via the supplemental tab on the article's online page at <http://dx.doi.org/10.1080/09535314.2015.1071706>.

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